MARYLAND

Agricultural Experiment Station.

SIXTH ANNUAL REPORT.

COLLEGE PARK, MD.

1893.

MARYLAND

Agricultural Experiment Station.

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Located on the B. & O. R. R., 8 miles N. of Washington, D. C.

NOTICE.

The bulletins of the Station will be mailed free to any citizen of Maryland who sends his name and address to the Station for that purpose.

Correspondents will please notify the Director of changes in their post-office address, or of any failure to receive the bulletins.

ADDRESS,

MARYLAND AGRICULTURAL EXPERIMENT STATION,

COLLEGE PARK, MARYLAND.

College Park, Prince George's County, Md.

January, 28th, 1893.

To His Excellency, Frank Brown,

Governor of Maryland:

DEAR SIR:—

In accordance with the provisions of Section No. 3, of Act of Congress, "To Establish Agricultural Experiment Stations, etc.," I beg leave to submit my report of the operations of the Maryland Agricultural Experiment Station, for the year ending December 31st, 1893; and also a statement of the receipts and disbursements for the fiscal year ending June 30th, 1893, covering the sixth annual appropriation.

Very respectfully,

ROBERT H. MILLER,
Director.

SIXTH ANNUAL REPORT

—OF THE—

Maryland Agricultural Experiment Station.

FOR THE YEAR 1893.

REPORT OF THE DIRECTOR.

The question is frequently asked, what are the general objects of Experiment Stations, and what is the character of the work which engages their attention? This is very clearly set forth in Section 2, of the Act by which they are established, and reads as follows:

"That it shall be the object and duty of said Experiment Stations to conduct original researches, or verify experiments, on the physiology of plants and animals; the diseases to which they are severally subject, with the remedies for the same; the chemical composition of useful plants at their different stages of growth; the comparative advantages of rotative cropping, as pursued under a varying series of crops; the capacity of new plants or trees for acclimation; the analysis of soils and water; the chemical composition of manures, natural or artificial, with experiments designed to test their comparative effects on crops of different kinds; the adaptation and value of grasses and forage plants; the composition and digestibility of the different kinds of food for domestic animals; the scientific and economic questions involved in the production of butter and cheese; and such other researches or experiments bearing directly on the agricultural industry of the United States as may in each case, be deemed advisable, having due regard to the varying conditions and needs of the respective States or Territories."

PROGRESS AND DEVELOPMENT OF THE STATION.

Station Staff.—With the object of broadening the field of the station work, two additions have been made to the staff in the past year, in the appointment of Prof. C. V. Riley to the chair of Physiology and Entomology, and Prof. Milton Whitney to that of Soil Physics; these gentlemen stand at the head of their respective professions, and the Station has cause for congratulation in the important additions to its staff.

It is hoped that the farmers and fruit growers of the State will avail themselves of the opportunity thus afforded, through the instrumentality of Prof. Riley, of obtaining information as to the many insect pests with which they have to contend, and the means with which to combat them.

Prof. Whitney's work, while comparatively new and therefore not as yet well understood, is very closely allied to the farmer's interests, and destined in the near future to play an important part in the advancement of agriculture. Mr. P. B. Hasbrouck has been appointed stenographer to succeed Mr. Frederick Alvy.

Publications.—During the past year the following publications have been issued:

*June, 1891, Bulletin No. 13, Strawberries.
*June, 1892, " " 17, Strawberries and Seed Potatoes.
*Oct. 1892, " " 18, Sweet Potatoes.
Jan. 1893, Fifth annual report.
Feb. 1893, Special bulletin "J" Composition of Commercial Fertilizers.
March, 1893, Bulletin No. 20, The Composition and Digestibility of the Different Parts of Corn Fodder.
June, 1893, Bulletin No. 21, The Soils of Maryland.
June, 1893, Special bulletin "K" Composition of Commercial Fertilizers.
Sept. 1893, Bulletin No. 22, Steer Feeding.
Dec. 1893, " " 23, Injurious Insects of Maryland.

Fairs and Institutes.—With the object of popularizing the Station with the farmers of the State, getting in closer touch with them, and giving useful object lessons, exhibits of its products have been made at a number of County Fairs, and much interest has been manifested in the displays. As one of the results of these exhibitions, there have been two hundred and eighty-four samples of wheat sent out at the request of farmers who wished to try new varieties. It is the intention of the Station to get reports of yields from as many of these farmers as can be obtained; in this way, aside from the useful information that is gained, a direct interest in the work of the Station is inaugurated which must be promotive of good results.

A large number of farmers' gatherings, such as institutes, granges, clubs, and road conventions, have been attended by members of the Station Staff, and papers read or addresses made. As these visits are generally by invitation, they are indicative of the growing interest in the Station's work.

Visitors.—While the number of visitors to the Station has at some seasons been quite gratifying; taking the year through, there have not been as many as we should like to see. We believe that there are many who are comparatively near by, who would be repaid by a visit to us.

Among other prominent guests whom we have had during the past year, may be mentioned, Dr. F. Wohltmann, Professor of Agriculture of the University of Breslau, Germany, and a member of the Legislature, of Switzerland, and the Director of the Experiment Station of Switzerland. These gentlemen seemed much interested in our work and their short visit to us was greatly enjoyed.

*Three that were in arrears.

Correspondence and Mailing List.—Two of the best evidences of the growing interest in the Station, are the large increase in the correspondence, and the additions to the mailing list, there having been nearly one thousand names added in the past twelve months of those who desired our bulletins. It being our wish to reach as many persons as possible, who are interested in farming; we are always glad to receive the names and addresses of such.

Buildings and Repairs.—The additions to the equipment of the Station during the past twelve months have been as follows: Three tobaoco barns, which have been used experimentally in testing the flue curing system, and a tool shed twenty by fifty feet with a corn crib in one end. This crib has what is a novel feature to many; it is lined throughout with half inch mesh, wire netting, which renders it perfectly mouse proof. While this is rather more costly than the plan which is commonly adopted for keeping out vermin, it is very much more effectual. In addition to the above buildings which have been erected: new floors have been laid on the hall and offices, and the board-walk at the rear of the building has been replaced by a substantial brick pavement. It is our intention the coming year to build a green house, a most necessary adjunct to a well equipped Station; one of its principal uses being the forcing of vegetables such as tomatoes, lettuce, etc., for an early market. Experience the past season justifies us in the belief that there is abundant opportunity, when one is properly equipped, for a profitable business: and it is one of the provinces of the Experiment Station to call attention to. and demonstrate the fact.

Farm Machinery.—A number of additions have been made to the stock of farm implements. A low down wagon made by Kemp & Burpee, of Syracuse, N. Y., is a most useful implement; it has a wide commodious body extending over the wheels which are only two feet eight inches high, and is suitable for hauling anything which may be raised on the farm, though not intended for general use on the road. A manure spreader, road scraper, mowing machine, horse rake, and fodder cutter or shredder, have also been purchased. The last named machine is made by W. R. Harrison & Co., of Canton, Ohio, and though only recently purchased and tested, we feel justified in the belief that it will supply a long felt want of the farmer, in furnishing a machine which will so prepare corn fodder, that not only his cattle, but his horses will have no difficulty in consuming most of the plant; the fodder thus prepared, having no hard butts to irritate the mouth as with the old style machines. Corn fodder—its preparation and economic use on the farm—because of its great importance, has received a large share of attention at the hands of the Station in past years, and it is contemplated continuing the investigations still further the coming year; one of the experiments being to test its feeding value as ordinarily used, as compared with the system of cutting or shredding and mixing the grain feed with it.

Liming and Manuring—Finding most of the land very barren of vegetable matter, and not typical of that of the state at large; we have

deemed it expedient to as rapidly as possible, raise the standard of it, and with this object, have applied stable manure to most of the sixty acres which constitute the Station farm. More than twenty carloads have been used in the past twelve months, beside that made on the place. Between five and six hundred bushels of stone lime has also been applied; and as one of the results we now have a fine set of grass. Part of the land has not received any manure, that we may test the use of green crops, such as peas, rye and crimson clover as renovators.

EXPERIMENTAL WORK, AGRICULTURAL DEPARTMENT.

Weather Report—The season of 1893 has not been favorable, either for general farming or for experimental work; there not being a single month of the four during which plants make their growth, that the two atmospheric conditions of heat and moisture, held anything like a proper relation to each other. The month of May, while having a temperature below the normal, had a rainfall much in excess of the usual amount for this month; the other three months, June, July, and August, while having about a normal temperature, were each of them very deficient in rainfall; there being only about one half the usual precipitation for the three months.

The following is a summary of the rainfall for this and preceding years at College Park.

YEARS.	1889	1890	1891	1892	1893
Rain-fall in inches ...	59.59	32.29	50.55	41.47	36.22
No. days on which rain fell	135	151	128	137	102

The following table gives a comparison of the rainfall at College Park, Washington, Baltimore and Cumberland, together with the normal precipitation for those places. Also the normal temperature and the mean temperature for 1893 at the same places.

PLACE OF RECORD.	TEMPERATURE.		RAIN AND SNOW FALL.	
	Normal.	Mean for 1893.	Normal in Inches.	In 1893 Inches.
College Park, Md.....	54.1	52.3	44 02	36 22
Washington, D. C.....	54.9	53 7	44.44	36.71
Baltimore, Md.....	55.6	53.6	44.34	32.15
Cumberland, Md.....	50 0	51.5	33.19	30.04

Drainage—A large amount of work has been done the past season in draining, both in land that was absolutely wet, and that which was only partially so. Open ditches from three to four feet deep, and 1121 yards in length have been cut, and 337 perches of tile have been laid. With the object of facilitating the work, and at the same time testing the implement, a ditching machine was procured of J. C. Elliot & Son's of Rittman Ohio. This machine is operated by two men and four horses, and under favorable conditions, it is claimed, will cut and fill in, 100 perches per day; but it will not work in very stony or wet land, and is not economically operated where the laterals are short. The advantage of deep ditching as compared with shallow, is demonstrated very strikingly in one of the fields of the Station Farm. The tiles which were previously laid, are about two feet below the surface, and those that were put down the past season, are in three foot ditches; the latter frequently discharging a good stream of water, when the others are practically dry.

Tobacco—The experiments made with tobacco have been with varieties, and testing different methods of curing; this latter work has been under the supervision of the chemical department, and will be reported under that division.

Wheat—The only experiment made with wheat, was with varieties; forty kinds having been tested. The ground was thoroughly prepared, and the wheat sown the latter part of September; 600 pounds of fertilizer per acre was applied; the nitrogen in this being supplied by nitrate of soda, and fish scrap. The idea in using the two forms being—that the nitrate, acting as it does very promptly, would give the wheat a good start in the Fall; and the fish scrap, being slower in its effects, would take up the work after the nitrate had been exhausted.—In mid-winter a top dressing of stable manure was applied, with a Kemp Manure Spreader, and about 20 bushels of stone lime to the acre. On harvesting and threshing it, a most gratifying return was the result; the 40 varieties averaged 32.2 bushels per acre—seven of them exceeded 40—and two made over 47 bushels per acre.

Potatoes—With potatoes, variety and fertilizer tests—hill vs. level culture—and subsoiling, were the experiments tried on the early crop; and the use of fungicides to prevent blight—and soaking the seed in a solution of corrosive sublimate to prevent the scab, with the late crop. The fertilizer tests with potatoes, as with all other crops the past season, have not been reliable, owing to the very severe drought previously referred to.

Very striking results were obtained from the use of corrosive sublimate for the prevention of scab; those that were treated, being practically free from it, while those untreated, were very much affected.

The Bordeaux mixture, while showing a decided advantage from its use, did not produce nearly so marked an effect on the crop, as it would have done, had the season not been so extremely dry.

Corn—Testing the proper width of rows, where corn is drilled—the depth to work whether deep or shallow—and the use of nitrate of soda, were the experiments made with corn. No apparent effect was gotten

from the nitrate, the dry weather interfering. The shallow working gave a larger return than the deep—and the narrow rows and thin seeding, was more profitable than wide rows and thick seeding.

Barley—As there is very little profit in wheat, at the prices which have obtained for several years past, and as barley seems to do well in this latitude, (one farmer in the state getting as much as 75 bushels to the acre the past season) we have sown three half acre plots of the winter variety, and shall sow a half acre of Spring barley in March or April, and compare them with the same number of plots of wheat which have been similarly treated; and by another season we can give some definite data as to the comparative profits of the two crops.

Crimson Clover—Various tests have been made the past season with this plant, and while we are not yet prepared to report results, we believe from the experience with its use at other Stations, and from what we have seen of it, that it may be made to perform a useful part in the farm economy as a nitrogen gathering plant, which will attain its full growth between seasons as it were; as when sown in August, or September, it is ready to cut or plow under in May. Having been informed that it would do well when sown in the Spring; making a good growth by August to plow under for wheat; it was sown last Spring, on a field which had been in corn the year before, and on which the crimson clover had failed to set. A good stand was secured, and while the ground was fairly well covered, it did not make the growth that was expected, and it is questionable whether it paid. Much of the clover that was sown the past season, was killed by the drought; but we have a good stand on one piece of corn stubble, and on land that was cropped in early potatoes and will be able to report effects another season. It is believed that the chances for getting a good stand on corn land, are much better when it is sown just ahead of the last working of the corn, the ground not being stirred too deep.

Forage Garden.—The following thirty-one varieties of grasses and clovers were sown the past season, with the object of testing their respective merits in this latitude, a description of them will be given in a future bulletin:

GRASSES.		CLOVERS.
Sheep Fescue.	Bromus Scheadeir.	Japan Clover.
Herd or Red-top.	Crested Dogstail.	Red Medium Clover.
Tall Meadow.	Fairmount Lawn.	Mammoth Red.
Meadow Fescue.	Hungarian Millet.	Crimson.
Yellow Oat.	Golden or Cream Millet.	Lucerne.
Sweet Vernal.	Johnson.	Yellow Trefoil.
Kentucky Blue.	Rhode Island Bent.	White Dutch.
Timothy.	Meadow Foxtail.	Alsike.
Orchard.	Tall Meadow Fescue.	Bokhara.
Italian Rye.	English Rape.	
English Rye.	Teosinte.	

Feeding Experiments.—An experiment in steer feeding was undertaken in December, 1892; the object being to ascertain the comparative profits of a well balanced, and a poorly balanced ration. The report of this test was given in bulletin No. 22. The results indicate that a well balanced ration is a very much more profitable feed than a poorly balanced one. The same test is being made again this winter for the purpose of verifying the results obtained last year. In addition to the above feeding experiment, one will be made with pigs on the same lines.

Co-operative Work.—As there are a great variety of soils in Maryland, and therefore, the fertilizer or combination of fertilizers which suit a certain locality are not necessarily the ones required in others, and with the object of determining the plant foods which it is necessary to supply to the soils of the various sections, fertilizer soil tests are being conducted on wheat in three different parts of the State; one in Talbot county, on the farm of Dr. Charles H. Lowndes; one in Harford county, on the farm of Mr. William L. Amoss; and one in Montgomery county, on the farm of Mr. Thomas J. Holland. The results obtained from these local tests should be of much practical value to farmers in the respective localities. Should time and money permit, we contemplate continuing and extending this work to other sections the coming year.

The Station has engaged in co-operative work for the U. S. Department of Agriculture in the past year, in addition to that referred to by Prof. Riley, in the Report of his department which follows. One of the principal undertakings having been the starting of quite a large walnut nursery.

Before concluding my report, I wish to express my appreciation of the co-operation and support extended to me at all times, by the Board of Trustees.

ROBERT H. MILLER,
Director.

REPORT FROM THE CHEMICAL DEPARTMENT.

To Robert H. Miller, Director:

SIR:—In compliance with your request, I herewith submit a statement as to the nature of the work of the Chemical Department during the year just ended.

The greater part of the work performed has been in connection with, and in continuation of investigations outlined in previous reports from this department. The results of one of these investigations, that on the Composition and Digestibility of Different Parts of the Corn Plant, has been reported in bulletin No. 20 of this Station; the other investigations are as yet more or less incomplete.

In pursuance of the policy of previous years, a certain amount of time has been spent in the study of methods of analyses. More time than heretofore, has been allotted to this study of methods for chemical research in relation to agriculture, from the fact that the nature of the investigations being conducted in the other departments of the Station, has called for little or no chemical work, as a check, or to further them; and also from the fact that the investigations which this department had been conducting in the field and in feeding, has been substituted by other experiments. The study of methods is a class of work that does not come directly in touch with the farmer and his operations and consequently does not appeal to him, and he is prone to think of it as a waste of time and money; nevertheless, on a moment's reflection, it will be apparent to all that it is a very necessary part of Station work. In fact, in the planning of an investigation, it is of paramount importance to be sure that the methods to be employed in the carrying out of that investigation are thorough and scrutinizing, so that the results obtained may be beyond reproach.

The demands on this department for analyses of a miscellaneous character, are constantly increasing; and whenever the samples so sent in are either of public interest, or have some direct bearing on agriculture or horticulture, they are examined gratuitously. Yet even with these considerations in mind, many of the samples which we receive are of interest to so few that the results of their analyses are not worthy of publication; the truth is that they almost belong to that class of analyses which were done yesterday—reported to-day—and to be forgotton to-morrow; consequently we do not believe in expending much time on such a class of substances and we always reserve the right to select for examination such as in our judgment are of most general interest and permanent value.

The equipment of the department remains substantially the same, though some important additions and repairs will soon be needed.

Yours respectfully,

H. J. PATTERSON,

Dec. 30th, 1893. Chemist.

REPORT OF THE DEPARTMENT OF HORTICULTURE.

Robert H. Miller, Director.

SIR:

I herewith have the honor to report on the character and extent of the work of this division.

Looking over the record of 1893, we are impressed with the fact that the products of the soil in whatever line of the toilers regard; whether of staple agriculture, the wealth of fruits, or the florist interests, as well as every other expression of human skill and industry, have felt the influence of that widespread depression which has left its impress on the universal business world.

The skill to command the largest difference between cost and price, is therefore the important present consideration. As between staple agriculture and its younger relations, the advantage of larger profits seems to be in the line of horticultural and floricultural pursuits, to those of our Maryland people who are fortunate as to technical skill, soil, and location. These conditions should be appreciated even in this field of competition. Some of the advantages in these departments are in the facts that no stored up surplus menaces by its presence, the harvest of the industry of another year. Stock gamblers may arrange on other lines the price of futures, but in this, an appreciative public demand for the best of everything in its line, challenges skill and judgment, and invites a wholesome speculation.

The Experimental Orchard.—In the experimental orchard the trees have made a fine growth, and have every appearance of healthfulness. The orchard is unfortunate as to location. It is margined its entire length by a fresh water tributary of the Potomac, and in addition to this, the soil is heavy and retentive of moisture, thus increasing both the risk of the winter killing of the buds, and the liability of damage by the late spring frosts. In the present instance, the buds were very largely winter killed. Among the peaches, Old Mixon, Crawford's Late, and Salway; and with pears, LeCompte, were the only varieties that were not killed.

Small Fruits.—With the small fruits the yield was abundant and the quality fine.

Grapes.—Of the fifty-two varieties of grapes, the results were especially satisfactory, both as to quality and quantity. Whether for commercial purposes or home enjoyment, it seems that the grape should receive a larger share of general attention, and no doubt would, if the means were more generally known by which to prevent the damage to this splendid fruit, from the invasion of the lower forms of insect and parasitic vegetable life. The Bordeaux mixture, if used in time, will prevent the one—the rosin wash will destroy a form of the other. Under favorable conditions of moisture and temperature, the vegetable parasite spreads most rapidly damaging the fruit and spotting the foliage. The summer of 1893 was in the main, from its dryness, more than ordinarily favorable to the maturity of the grape crop. Notwithstanding this, however, the beneficial

effects of the use of the Bordeaux mixture was clearly apparent, both in foliage and fruit.

Strawberries.—Forty-three varieties of strawberries fruited at the Station the season of 1893. The line of investigation as to these was, as to their relative maturity and other points of comparative merit— results as to the economic value of the use of different fertilizers—and remedial treatment for insect pests. On account of the general interest in strawberry culture, a number of varieties not hitherto tested at the Station, were secured and planted the spring of 1893. We now have growing at the Station, and expect to fruit the coming year, ninety-five different varieties.

Blackberries.—With blackberries the conclusions as to the varieties on hand were, that the Early Harvest and Wilson showed the largest measure of excellence. The scope of work in this instance has been increased by the planting of a number of additional varieties of both high and low bush.

Raspberries.—The leading varieties of the red, black and yellow sorts have been planted, and should give results the coming season.

Currants and Gooseberries.—The leading varieties of these have been planted and promise well.

Tomatoes.—The culture of the tomato as a field crop, is a large item in the industry of the State, and we felt warranted therefore in giving it especial interest. The plan of work with it was outlined on three expectations; variety test—fertilizer test—and a shipping test. The results demonstrated were the marked difference of yield, as between varieties, difference of yield as between strains of the same variety—effect on yield and maturity by fertilizers—and the large measure of profit by the availment of the markets outside of the local competition. The net profit on a shipment North on the 2nd of August, was $1.58 per bushel; as against 50 cents per bushel gross, in Baltimore and Washington.

Peas and Beans.—In several sections of the State, these are extensively grown as field crops to supply the market, as well as the demand from the canning establishments. Disappointment as to yield is frequently expressed, which is often referable no doubt to parasitic growths. The varieties of both peas and beans were planted for experimentation.

Potatoes.—Among our garden experiments, some special varieties of white potatoes were planted: Van Arnam's Superb, Extra Early, second Crop, Early Rose, Vanguard and World's Fair. Notwithstanding the very unfavorable season for potatoes, the Superb, Vanguard, and Extra Early, in the order named, attracted very favorable comment at the different county fairs where they were exhibited: both as to yield, and quality of product. Second crop, Early Rose and World's Fair, appeared to be more affected by the unfavorable season, than the other varieties named.

The Sugar Corns, Radishes, Cabbage and Lettuce had their share of attention.

Very Respectfully,

JAMES S. ROBINSON, *Horticulturist.*

REPORT OF THE PHYSIOLOGIST AND ENTOMOLOGIST.

To Robert H. Miller, Director:

SIR:—In accordance with your request, I beg to submit herewith a very brief account of the operations of my department for the year 1893.

Owing to the fact that the Department of Physiology and Entomology was established rather late in the season, field and laboratory work was not begun until nearly the first of August, when an assistant, Mr. R. S. Lull, was permanently established at the Station. The professorship is not a full-paid one, and therefore is partly honorary; the arrangement entered into by the Station and the Division of Entomology of the National Department of Agriculture, of which I have charge, being made for the mutual benefit of the Division and the Station—the Station co-operating with the Division in facilities for experimental field work, and the Division co-operating with the Station by means of its experience and museum facilities. The correspondence during the year has been, for the most part, conducted from Washington, while the field work—largely entrusted to Mr. Lull's supervision, with occasional visits by myself to the Station—was done at College Park. Considerable correspondence has been had in reply to inquiries, and Station Bulletin No. 23, on "Some Injurious Insects of Maryland," has been published. A beginning was at once made in establishing a series of notes on the injurious insects of Maryland, compiling in the first place, a brief account of important facts in life histories and remedies from earlier published sources, and adding to these accounts full reports of observations made at the Station. In this way, during the latter part of the season, the following insects were studied:

The Melon Plant-louse (*Siphonophora cucurbitæ*), the Cabbage Plant-louse (*Aphis brassicæ*), the Strawberry Root-louse (*Aphis forbesi*), the Grapevine Phylloxera (*Phylloxera vestatrix*), the plum Curculio (*Conotrachelus nenuphar*), the Codling Moth (*Carpocapsa pomonella*), the Tobacco Horn-worm (*Protoparce carolina*), several Flea-beetles, notably (*Epitrix cucumeris*), the Green June-beetle (*Allorhina nitida*), and the Grapevine Aspidiotus (*Aspidiotus uvæ*). Briefer notes were made upon several other species of perhaps lesser economic importance. Three of the above insects were studied with more care than the rest, owing to their apparently greater economic importance during the season. These were the Green June-beetle (*Allorhina nitida*), the larvæ of which occurred in extraordinary abundance in the celery-beds of Col. Wright Rives, of Rives Station, the Root Aphis of the Strawberry (*Aphis forbesi*), which was found abundantly on the Experiment Farm and also in Harford and other counties of the State, and which seems to be doing considerable damage, and a grapevine scale which is interesting on account of the fact that it has not previously been publicly reported as occurring in the

State, although notes of its occurrence at Soldiers' Home, just outside of Washington, are contained in the note-books of the Division of Entomology of the Department of Agriculture. Reasonably full accounts of the first two of these insects are published in Bulletin No. 23; the Grapevine Aspidiotus is being studied with considerable care, and several stages not previously described have been made out. Experiments with remedies made during the autumn show that the resin wash in use in California as a winter wash against armored scales is effective against the species. It is interesting to note that this scale in Maryland is attacked by a parasite, as evidenced by minute holes in the old scales and by the fact that a single female has been found which upon examination brought to the attention a parasitic larva. The adult parasite has not been reared and determination as yet is impossible. No parasite has hitherto been recorded from this scale. A large number of experiments with insecticides have been made during the autumn. Aside from those detailed in the Bulletin and the resin wash experiment just mentioned, several patented insecticides have been tested and bisulphide of carbon has been used with the most perfect success against the Angoumois Grain Moth. A series of experiments were also made with the Bordeaux mixture against Potato Blight. The result of this experiment, however, will probably be given by the Agriculturist.

A beginning has been made in the formation of a Station collection of insects, and although late in season, a very fair nucleus of the more common insects of this portion of the State was secured, carefully mounted, and arranged in temporary boxes. A number of alcoholic specimens of larvæ, plant lice, and a few spiders, were prepared, a number of breeding jars were stored with insects, and two good cages were constructed, which, with the specimens, proved of great interest to the visiting farmers. These specimens are so far preserved in folding boxes, and I strongly recommend that a well-made, permanent cabinet be furnished for the preservation of a State collection; for, with the material which I can furnish from the duplicate series of the national collection, a valuable reference cabinet could soon be formed, which would be of value to students as well as to myself in carrying on the work of the Department.

Respectfully yours,

C. V. Riley,

Physiologist and Entomologist.

REPORT OF PHYSICIST.

To Robert H. Miller, Director:

SIR:—The investigations of the soils of Maryland have had a threefold object: To determine the cause of the distribution of plants and crops in the State, that is, why some soils are better suited to certain crops than others; to outline the area of these different soils on a map; to study the cause of the deterioration of the wheat and tobacco lands of southern Maryland. This work has all been covered in a preliminary way except for the soils of the Eastern Shore. The cause of the especial adaptability of the different soils to crops has been determined.

A map has been prepared showing the area of the principal soil formations of the State; and the cause of the deterioration of the tobacco and wheat lands of southern Maryland has been determined, so far as this can be determined, by investigations in the laboratory. Two bulletins have been issued by the Station explaining the details of these investigations.

With the co-operation of Johns Hopkins University, the United States Geological Survey, the United States Weather Bureau and the Maryland State Weather Service, a large colored map has been prepared showing the different geological formations in the State and the principal soil formations. A large edition of this map was published in the handbook of Maryland, issued by the World's Fair Commissioners, and a second edition, together with ten large climatic charts and three pages of explanatory text have been issued by the State Weather Service. The soils of the Eastern Shore are not shown upon the map for the reason that they have not yet been studied in sufficient detail. I have made two extended trips through the Eastern Shore and have collected a large number of samples, but on account of an interruption in the work I have not been able to complete the examination of these samples.

I recommend that the investigations of the soils on the Eastern Shore be completed so that these soil formations may also be outlined on the map; and the areas adapted to truck, fruit, grain, and other important agricultural lines, be plainly shown upon the map.

I have evidence from my laboratory investigations that the cause of the deterioration of the tobacco and wheat lands of southern Maryland is due to a re-arrangement of the grains of sand and clay in the soil in consequence of which the soils have become less retentive of moisture than formerly. These results should be confirmed by further careful investigations of the soils in the field, and the methods proposed for the amelioration of these conditions and the improvement of the soils should be carefully studied on rather a large scale by actual field trials, and I recommend that this should be done in the coming season.

These are the principal lines which should claim our attention in the coming year.

The most cordial relations are still maintained with the Johns Hopkins University, and I may repeat what I have said in former reports, that without the facilities and assistance which I have enjoyed in the use of their laboratories and libraries, and through the cordial advice, criticism and help of the Professors and Instructors, this work would not have been carried to the full development it has attained. I regret to say that the co-operation with the United States Department of Agriculture in the development of these soil investigations was terminated on June 30th.

Respectfully yours,

MILTON WHITNEY,

Physicist.

THE ANNUAL FINANCIAL REPORT, 1892–1893.

The Maryland Agricultural Experiment Station in Account with the United States.

1893.			DR.
June 30.	To Receipts from the Treasurer of the United States in four payments, per appropriation for the year ending June 30, 1893, under act of Congress, approved March 2, 1887	$ 15,000.00	
April 14.	To cash from sale of Beeves.....	477.52	
June. 7.	" " from sale of Sundries.....	10.60	
			$ 15,488.12

1893.	CREDITS.	AMT.
June 30	By Salaries.....	$ 5,972.53
" 30	By Labor.....	2,267.25
" 30	By Freight and Expressage., ...	385.15
" 30	By Postage and Stationery.....	52.35
" 30	By Printing and Office Expenses....	1,390.58
" 30	By Library and Museum.....	159.50
" 30	By Tools, Apparatus, etc.....	845.44
" 30	By Building.....	573.99
" 30	By Exhibitions and Meetings.....	284.49
" 30	By Feeding Experiments.....	396.50
" 30	By Travel and Board Meetings.....	245.04
" 30	By Soil Examinations.....	67.85
" 30	By Tobacco Experiments.....	415.13
" 30	By Supplies	2,428.37
" 30	By Balance Unexpended.....	3.95
		$ 15,488.12

I hereby certify that the foregoing is a true transcript from the books of account of the Maryland Agricultural Experiment Station for the fiscal year of 1893.

JOS. R. OWENS,
Registrar and Treasurer.

We, the undersigned, duly appointed Auditors for the Corporation, do hereby certify that we have examined the books and accounts of the Maryland Agricultural Experiment Station, for the fiscal year ending June 30, 1893: that we have found the same well kept and correctly classified as above, and that the receipts are shown to have been $15,488.12, and the corresponding disbursements, $15,486.17, for all of which proper vouchers are on file, and have been examined by us and found correct. The balance of $3.95 to be accounted for by the Treasurer in the fiscal year, commencing July 1st, 1893.

(Signed)

CHARLES B. CALVERT, } *Auditing Committee,*
J. P. SILVER. } *Board of Trustees.*